DOCUMENT RESUME

ED 368 428 JC 940 237

TITLE Guidelines for the Academic Preparation of Mathematics Faculty at Two-Year Colleges.
INSTITUTION American Mathematical Association of Two-Year Colleges.
PUB DATE 7 Nov 92
NOTE 11p.; Approved by the AMATYC Delegate Assembly (Indianpolis, IN, November 7, 1992).
PUB TYPE Guides - Non-Classroom Use (055)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *College Mathematics; College Role; Community Colleges; *Continuing Education; Full Time Faculty; *Mathematics Teachers; Part Time Faculty; Professional Training; Standards; *Teacher Education; Teacher Education Curriculum; Teacher Effectiveness; *Teacher Qualifications; *Two Year Colleges

ABSTRACT

Addressed to two-year college professionals responsible for staffing and evaluating mathematics programs and university personnel responsible for programs that prepare college mathematics teachers, this document provides recommendations for training effective community college mathematics faculty adopted by the American Mathematical Association of Two-Year Colleges. Following a statement of purpose and discussion of the factors that motivated the development of the guidelines, recommendations for the formal preparation of mathematics faculty are provided. These guidelines indicate that the minimum requirements of full- and part-time faculty should be at least a master's degree in mathematics or a related field with at least 18 semester hours in graduate-level mathematics; that the standard preparation of full-time instructors should be at least 30 semester hours toward a master's degree, with secondary or collegiate teaching experience; and that mathematics faculty should continue formal advanced coursework towards Doctor of Arts, Doctor of Philosophy, Doctor of Education, or a second master's degree. Next, essential areas of mathematical and pedagogical content are outlined, indicating that course work should include discrete mathematics, computer science, calculus, algebra, and geometry, as well as the psychology of learning mathematics, techniques of mathematics instruction, and mathematics for adult learners and special needs students. Finally, closing sections discuss the role of continuing education in faculty preparation and part-time mathematics faculty. Contains 17 references and a course outline for college mathematics faculty preparation. (ECC)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 368 428

GUIDELINES FOR THE ACADEMIC PREPARATION OF MATHEMATICS FACULTY AT TWO-YEAR COLLEGES

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

D. Cohen

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

X This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

American Mathematical Association of Two-Year Colleges

JC 940 237

BEST COPY AVAILABLE

Guidelines For The Academic Preparation Of Mathematics Faculty At Two - Year Colleges

Approved by the AMATYC Delegate Assembly on 7 November 1992 in Indianapolis, Indiana

Qualifications Subcommittee of the AMATYC Education Committee

Gregory D. Foley, Sam Houston State University, Chair, 1986-1992
Pansy Brunson, Community College of Western Kentucky University, 1987-1992
Robert L. Carson, Lower Columbia College, 1986-1987, 1990-1992
Sharon Douglas, Cochise College, 1990-1991
David Ellenbogen, St. Michael's College, 1986-1988
Michael E. Greenwood, Clark College, 1986-1992
Lou Hoelzle, Bucks County Community College, 1987-1988
Sue Parsons, Cerritos College, 1990-1992

Preface

Work on Guidelines for the Academic Preparation of Mathematics Faculty at Two-Year Colleges began in 1986, when the Qualifications Subcommittee of the Education Committee of the American Mathematical Association of Two-Year Colleges (AMATYC) was formed. Extensive research - as well as consultation with other organizations, AMATYC committees, and mathematics faculty-led to this document. Developing and producing such a document and then obtaining all the necessary approvals to make it official was a long and arduous task. AMATYC is deeply indebted to Gregory D. Foley, Qualifications Subcommittee Chairperson (1986-1992), as well as the members of his subcommittee.

The report now presents, as much as is possible, a shared vision for the academic preparation of two-year college mathematics faculty. As its name implies, the report is intended to guide rather than control. It outlines one set of guidelines for all two-year college mathematics faculty. The most important recommendation of the report, however, is that "hiring committees for mathematics positions at two-year colleges should consist primarily of full-time two-year college mathematics faculty." They are the most qualified and have the best professional judgment to make appropriate hiring decisions, based upon any local constraints that may exist.

Karen Sharp
AMATYC President (1991-93)

Statement of Purpose

This document is addressed to two-year college professionals involved in the staffing and evaluation of mathematics programs for their colleges, and to universities that have, or will develop, programs to prepare individuals to teach mathematics in two-year colleges. It is not intended to replace any regional, state, or local requirements or recommendations that may apply to hiring instructors, assigning them to classes, or evaluating their performance or qualifications. Rather, our goal is to provide guidelines that reflect the collective wisdom and expertise of mathematics educators throughout the United States and Canada regarding appropriate preparation for two-year college faculty involved in the teaching of mathematics, whether on a full- or part-time basis.

We strongly recommend that only properly qualified personnel be permitted to teach mathematics. Ill-prepared instructors can do much harm to students' knowledge of and beliefs about mathematics. Many two-year college students suffer from mathematics anxiety; this should not be reinforced or exacerbated through inappropriate mathematics instruction. **Individuals trained in other disciplines should not be permitted to teach mathematics unless they have received sufficient mathematical training as well.** Moreover, individuals hired to teach mathematics at one level should not be permitted to teach at another level unless they possess appropriate credentials.

We are guarding the gates of our profession. This is our responsibility as the leading professional mathematics organization that solely represents two-year colleges. Staffing practices and procedures vary greatly from college to college and from region to region. We wish to ensure the integrity of our profession and the quality of mathematics instruction at all two-year colleges.

Motivating Factors

Disturbing Trends

Reports such as *Everybody Counts: A Report to the Nation on the Future of Mathematics Education* (National Research Council, 1989) document deep-rooted problems concerning mathematics education in the United States. Among these problems is the need to teach meaningful mathematics to individuals from all social, economic, ethnic, and racial backgrounds. This is imperative if our nation is to maintain a leadership role in the world of the future. The mathematics community should especially strive to increase participation of groups that are underrepresented in mathematics.

Two-year colleges can play a major role in turning our country around in this regard. A study conducted during the 1985-1986 academic year revealed that, among two-year college students, "one-fourth are minority students, and more than one-half are women" (Albers, Anderson, & Loftsgaarden, 1987, p. 112). Steen et al. (1990) reported that, "One-third of the first and second year college students in the United States are enrolled in two-year colleges, including over two-thirds of Afro-American, Hispanic, and Native American students" (p. 13). Two-year colleges are critical to the national effort to recruit and retain minority students and women as majors in mathematics and mathematics-dependent fields. Two-year college mathematics teachers must be prepared to help and encourage students from these underrepresented groups.

Many two-year college mathematics instructors are nearing retirement age (Albers, Anderson, & Loftsgaarden, 1987). We must work hard at recruiting and preparing the next generation of two-year college faculty, and enable them to thrive as college mathematics teachers in our rapidly changing world.

Curriculum Reform Movements

The forces of curricular change have reached a relative maximum. The *Curriculum and Evaluation Standards for School Mathematics* (Commission on Standards for School Mathematics, 1989) and *Calculus for a New Century* (Steen, 1988) call for major changes in the content and methods of school and college mathematics. These and other related calls for reform (e.g., National Research Council, 1989, 1991) are due in part to the implica-

tions of the pervasiveness of computer technology in our society and in part to the sagging mathematics achievement of students. It is appropriate that we now reexamine the preparation of two-year college mathematics faculty.

Guiding Principles

Two questions have guided the preparation of this report: What are the characteristics of an effective mathematics teacher? How can these characteristics be fostered and extended through academic preparation and continuing education?

The growing body of research related to effective mathematics teaching (Grouws, Cooney, & Jones, 1988) indicates that effective mathematics teachers use their time wisely and efficiently, both in and out of class; they present well organized lessons; and they know their subject. Effective instructors are reflective; they think about their teaching before they teach, while they teach, and after they teach. They are creative, resourceful, and dedicated. They use a variety of methods and respond to the needs of the particular class and students they are teaching. Effective mathematics teachers are skilled questioners who encourage and challenge their students. They are clear and careful communicators who recognize the importance of language in mathematics, and mathematics as language. They model the behaviors they wish their students to exhibit, especially problem solving, exploration, and investigation.

Effective mathematics instructors know a great deal of mathematics and understand the interconnections among its various branches as well as applications to other disciplines. They are continually developing their knowledge and understanding of mathematics, of teaching, and of how students learn. They are independent learners who can adapt and contribute to changes in collegiate mathematics curriculum and instruction.

Effective mathematics instructors are active professionals. They read journals, attend professional meetings, and engage in other professional activities. Impagliazzo et al. (1985) further elaborated on the activities and characteristics of professionally active mathematics instructors in *The Two-Year College Teacher of Mathematics*. The present report outlines the academic preparation and continuing education necessary for a person to be an effective mathematics teacher at the two-year college level.

Organization of the Report

The remainder of this report is organized into four sections. The first concerns guidelines for the formal preparation of two-year college mathematics faculty. The second outlines important areas of mathematical and pedagogical content that should be included in such preparation. The third section discusses avenues other than formal education for continuing education. The final section briefly addresses the issues of part-time instructors and the desirability of diversity within a mathematics department. These sections are followed by a bibliography and an appendix that contains an outline for a course on college mathematics teaching. Such a course should be offered by universities that prepare two-year college mathematics instructors, and should be included in the academic preparation of these instructors.

Guidelines for Formal Preparation

Mathematics programs at two-year colleges reflect their diverse missions and particular needs. Mathematics instruction at a comprehensive community college may comprise adult basic education to prepare students for a high school equivalency examination; developmental and precollege vocational and technical courses designed to prepare students for college credit courses; courses for students in college-level vocational and technical programs; university-transfer courses through vector calculus, differential equations, and linear algebra; and continuing education courses that do not carry college credit. Other colleges may focus only on a subset of these types of instruction. Many two-year technical colleges, for example, focus on precollege and college-level vocational and technical courses.

Because of this diversity, the standard for the mathematical preparation of two-

year faculty must be sufficiently robust to guarantee faculty flexibility. This standard is divided into three parts: minimal preparation, standard preparation, and continuing formal education.

Definitions

All full- and part-time faculty should possess at least the qualifications listed under *minimal preparation*. All full-time faculty should begin their careers with at least the qualifications listed under *standard preparation*. All faculty should continue their education beyond this entry level. The *continuing formal education* section provides some suggestions. Continuing education of a less formal nature is not only valuable but essential. Avenues for informal continuing education are discussed later in this report. Continuing formal education that requires full-time university enrollment is best undertaken after several years of teaching.

The terms *faculty* and *instructors* are used interchangeably to refer to persons who hold teaching positions. No particular level within a ranking system is implied by either of these terms.

Courses in physics, engineering, and other fields can contain significant mathematical sciences content. Although there is no simple, set formula for doing so, such courses should be taken into account by two-year college mathematics hiring committees when evaluating a candidate's transcripts. Similarly, such courses should be carefully considered by university personnel when making program admission decisions and advising students who hold or may seek two-year college mathematics teaching positions.

Minimal Preparation

All full- and part-time mathematics instructors at two-year colleges should possess at least a master's degree in mathematics or in a related field with at least 18 semester hours (27 quarter hours) in graduate-level mathematics. A master's degree in applied mathematics is an especially appropriate background for teaching technical mathematics. Course work in pedagogy is desirable.

Standard Preparation

All full-time mathematics instructors at two-year colleges should *begin* their careers with at least a master's degree in mathematics or in a related field with at least 30 semester hours (45 quarter hours) in graduate-level mathematics and have mathematics teaching experience at the secondary or collegiate level. The teaching experience may be fulfilled through a program of supervised teaching as a graduate student. Course work in pedagogy is desirable.

Continuing Formal Education

All mathematics instructors at two-year colleges should continue their education beyond the entry level. Appropriate continuing formal education would include graduate course work in mathematics and mathematics education beyond the level of the individual's previous study. Such advanced study may culminate in one of the following degrees: Doctor of Arts in mathematics, PhD or EdD in mathematics education, or PhD in mathematics. For mathematics instructors at two-year technical colleges, taking courses in technologies served by the two-year college mathematics curriculum is also appropriate. Advanced studies may result in a second master's degree.

Evaluating Credentials

A great deal of specialized knowledge and judgment is required to evaluate a candidate's credentials. **For this reason, hiring committees for mathematics positions at two-year colleges should consist primarily of full-time two-year college mathematics faculty.** All staffing decisions related to mathematics instruction—whether full- or part-time—should be made by content specialists.

The Course Content of a Preparatory Program

Mathematics Content

The core of the academic preparation of two-year college mathematics instructors is course work in the mathematical sciences. The mathematics course work for individuals preparing to be two-year college mathematics instructors should include courses chosen from several of the following areas.

Graduate course work should fill gaps, broaden, and extend the undergraduate mathematics background of such individuals.

- Discrete Mathematics
- Computer Science
- Mathematical Modeling and Applications
- Calculus through Vector Calculus
- Differential Equations
- Real Analysis
- Numerical Analysis
- Complex Variables
- Linear Algebra
- Abstract Algebra
- Probability
- Statistics
- History of Mathematics
- Number Theory
- Geometry
- Topology
- Combinatorics

Pedagogical Content

Course work in pedagogy is an important component in the academic preparation of two-year college mathematics instructors. Such course work should be chosen from the areas listed below. Courses in these areas should be offered by universities that prepare two-year college mathematics instructors.

- Psychology of Learning Mathematics
- Methods of Teaching Mathematics
- Organizing and Developing Mathematics Curricula and Programs
- Instructional Technology
- Teaching Developmental Mathematics
- Using Calculators and Computers to Enhance Mathematics Instruction
- Measurement, Evaluation, and Testing
- Teaching Mathematics to Adult Learners
- Teaching Mathematics to Special-Needs Students
- College Mathematics Teaching Seminar (see the Appendix)

Continuing Education

As noted earlier, effective mathematics instructors are active professionals. They read journals, attend professional meetings, and engage in other activities to continue their education. The American Mathematical Association of Two-Year Colleges (AMATYC), the Mathematical Association of America (MAA), the National Council of Teachers of Mathematics (NCTM), and other organizations sponsor conferences, offer minicourses and summer institutes, publish books and journals, and advertise other opportunities for continued professional growth. AMATYC, MAA, and NCTM workshops, minicourses, and institutes address many of the mathematical and pedagogical topics listed in the previous section. Participation in these activities is critically important in order for two-year college mathematics faculty to keep up-to-date in their field.

Closing Comments

Part-Time Faculty

Ideally, part-time instructors should possess the same level of preparation and commitment to quality teaching as full-time instructors. An MAA committee report entitled *Responses to the Challenge: Keys to Improving Instruction by Teaching Assistants and Part-Time Instructors* (Case, 1988) addresses this issue at length. We support the views of this report as they pertain to two-year college part-time mathematics faculty.

Variety of Expertise

A mathematics department should be composed of individuals who possess complementary strengths and areas of expertise. This is especially true within a comprehensive community college with a wide variety of degree programs. A mathematics department with experts or specialists in pedagogy, statistics, computing, applied mathematics, analysis, and history of mathematics is generally much stronger than one in which all members have similar academic backgrounds. This together with programmatic needs and candidate qualifications should be taken into account when seeking and hiring full- and part-time faculty.

Bibliography

Albers, D. J., Anderson, R. D., & Loftsgaarden, D. O. (Eds.). (1987). *Undergraduate programs in the mathematical and computer sciences: The 1985-1986 survey* [MAA Notes No. 7]. Washington, DC: Mathematical Association of America.

Case, B. A. (Ed.). (1988). *Responses to the challenge: Keys to improving instruction by teaching assistants and part-time instructors* [Report of the Committee on Teaching Assistants and Part-Time Instructors, MAA Notes No. 11]. Washington, DC: Mathematical Association of America.

Case, B. A. (Ed.). (1991). *Preparing for college teaching* [Preprint of portions of the report of the Committee on Preparation for College Teaching, which is due to appear in 1993]. Washington, DC: Mathematical Association of America.

Commission on Standards for School Mathematics. (1989). *Curriculum and evaluation standards for school mathematics.* Reston, VA: National of Teachers of Mathematics.

Committee on the Mathematical Education of Teachers (COMET). (1988). *Guidelines for the continuing mathematical education of teachers* [MAA Notes No. 10]. Washington, DC: Mathematical Association of America.

Davis, R. M. (Ed.). (1989). *A curriculum in flux: Mathematics at two-year colleges: A report of the Joint Subcommittee on Mathematics Curriculum at Two-Year Colleges.* Washington, DC: Mathematical Association of America.

Greenwood, M. E. (1976). *A report on the training of community college mathematics teachers.* Unpublished manuscript, University of Illinois, Urbana-Champaign, and Clark College, Vancouver, WA.

Grouws, D. A., Cooney, T. J., & Jones, D. (Eds.). (1988). *Perspectives on research on effective mathematics teaching.* Reston, VA: National Council of Teachers of Mathematics, and Hillsdale, NJ: Lawrence Erlbaum Associates.

Impagliazzo, J. (Chair), Ayers, S. W., Lindstrom, P., & Smith, J. B. (1985). *The two-year college teacher of mathematics.* American Mathematical Association of Two-Year Colleges.

Leitzel, J. R. C. (Ed.). (1991). *A call for change: Recommendations for the mathematical preparation of teachers of mathematics* [Report of the Committee on the Mathematical Education of Teachers (COMET)]. Washington, DC: Mathematical Association of America.

Long, C. T. (1985). The academic training of two-year college mathematics faculty. In D. J. Albers, S. B. Rodi, & A. E. Watkins (Eds.), *New directions in two-year college mathematics: Proceedings of the Sloan Foundation conference on two-year college mathematics* (pp. 393-403). New York: Springer-Verlag.

National Research Council. (1989). *Everybody counts: A report to the nation on the future of mathematics education.* Washington, DC: National Academy Press.

National Research Council. (1990). *Reshaping school mathematics: A philosophy and framework for curriculum.* Washington, DC: National Academy Press.

National Research Council. (1991). *Moving beyond myths: Revitalizing undergraduate mathematics.* Washington, DC: National Academy Press.

Steen, L. A. (Ed.). (1988). *Calculus for a new century: A pump, not a filter* [MAA Notes No. 8]. Washington, DC: Mathematical Association of America.

Steen, L. A. (Ed.). (1989). *Reshaping college mathematics: A project of the Committee on the Undergraduate Program in Mathematics* [MAA Notes No. 13]. Washington, DC: Mathematical Association of America.

Steen, L. A. (Chair), Goldstein, J. A., Jones, E. G., Lutzer, D., Treisman, P. U., & Tucker, A. C. (1990, November-December). Challenges for college mathematics: An agenda for the next decade [Center section insert]. *Focus: The Newsletter of the Mathematical Association of America, 10*(6).

APPENDIX

Outline for a Course in College Mathematics Teaching

Nature of the Course: The course should be a seminar focusing on timely and timeless issues faced by teachers of collegiate mathematics.

Participants: Enrollment should be open to all graduate students in mathematics and mathematics education.

Topics: Topics should be chosen chiefly from among those listed below:

1. *Teaching Issues:* Motivating ideas, motivating students, conveying the nature of mathematics, effective use of calculators and computers to convey mathematical ideas, learning theory, teaching for understanding, teaching problem solving, characteristics of effective mathematics teachers, individualized instruction, the use and grading of written assignments, teaching adult learners, testing and grading.
2. *Program Issues:* Curricular trends, textbook selection, course and program development, course and program evaluation, student advising, placement of students.
3. *Other Issues:* Writing for publication, committee work, professional meetings, service. This discussion should include (a) organizations and publications, (b) types of institutions, and (c) finding and retaining jobs.

Activities: Practice presentations and lessons, discussions of issues, outside readings, sharing of obtained information, writing, computer demonstrations, hands-on computer and calculator activities, guest speakers, videotapes, and films.

Suggested Requirements:

1. Attendance at all meetings, participation in all activities including discussions of assigned readings (a bound collection of readings can be made available for purchase at a local outlet).

2. Term paper within the area of the impact of new technology on undergraduate mathematics education, or other appropriate topic: one draft plus a final manuscript.

3. A 10-15 minute conference-style presentation with handouts and prepared transparencies.

4. Presentation of a classroom-style lesson with a computer-demonstration, workshop, or other innovative format.

5. Preparation of the following documents: (a) a biographical sketch; (b) a chronological list of graduate courses with date, instructor, and institution; and (c) a full curriculum vitae.

Textbooks could be chosen from:

Albers, D. J., Rodi, S. B., & Watkins, A. E. (Eds.). (1985). *New directions in two-year college mathematics: Proceedings of the Sloan Foundation conference on two-year college mathematics.* New York: Springer-Verlag.

Davis, R. M. (Ed.). (1989). *A curriculum in flux: Mathematics at two-year colleges.* Washington, DC: Mathematical Association of America.

National Research Council. (1991). *Moving beyond myths: Revitalizing undergraduate mathematics.* Washington, DC: National Academy Press.

Ralston, A., & Young, G. S. (Eds.). (1983). *The future of college mathematics: Proceedings of a conference/workshop on the first two years of college mathematics.* New York: Springer-Verlag.

Schoenfeld, A. (Ed.). (1990). *A source book for college mathematics teaching.* Washington, DC: Mathematical Association of America.

Steen, L. A. (Ed.). (1988). *Calculus for a new century: A pump, not a filter* [MAA Notes No. 8]. Washington, DC: Mathematical Association of America.

Steen, L. A. (Ed.). (1989). *Reshaping college mathematics: A project of the Committee on the Undergraduate Program in Mathematics* [MAA Notes No. 13]. Washington, DC: Mathematical Association of America.

Sterrett, A. (Ed.). (1990). *Using writing to teach mathematics* [MAA Notes No. 16]. Washington, DC: Mathematical Association of America.

Tucker, T. W. (Ed.). (1990). *Priming the calculus pump: Innovations and resources* [MAA Notes No. 17]. Washington, DC: Mathematical Association of America.

Zimmermann, W., & Cunningham, S. (Ed.). (1991). *Visualization in teaching and learning mathematics* [MAA Notes No. 19]. Washington, DC: Mathematical Association of America.

AMATYC Executive Board
(1991 - 1993)

President: Karen Sharp
Mott Community College

President-Elect: Marilyn Mays
North Lake College

Secretary: Wanda Garner
Cabrillo College

Treasurer: Margie Hobbs
State Technical Institute at Memphis

Past President: Dale Ewen
Parkland College

Regional Vice - Presidents

Northeast: Carol Eaton
SUNY College of Agriculture

Mid-Atlantic: Susan S. Wood
J.S. Reynolds Community College

Southeast: Bill Jordan
Seminole Community College

Midwest: David Gustafson
Rock Valley College

Central: Helen Banes
Kirkwood Community College

Southwest: Therese Jones
Amarillo College

Northwest: Vicky Ringen
North Seattle Community College

West: Bill D. New
Cerritos College

BEST COPY AVAILABLE